CERTS Demand Response Amendment

Contract #: 150-99-003 **Project #:** 2
Contractor: Lawrence Berkeley National Laboratory
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Status: Completed

Project Description:
The Lawrence Berkeley National Laboratory, acting on behalf of the Consortium for Electric Reliability Technology Solutions, has completed three related research activities in the area of demand response. The three activities were guided by two overarching research questions. They are:

- What can the State do to help build real-time energy information, signaling, and response infrastructure that is flexible and simple enough so that it can address the next energy crises not only the last one?
- What are the most effective strategies (technology, tariffs, etc.) related to deploying a real-time demand responsiveness system that are cost-effective, require minimal end-user interaction, and yet are effective?

The completion of the activities has contributed to improved understanding of the following demand response issues:

1. The current status of California's demand response (DR) capabilities for typical large commercial, semi-industrial and institutional (LCI&I) facilities.
2. Customer response to tariffs.
3. The technologies and systems required by California Independent System Operator (CAISO) so that it can manage a real-time two-way signaling system.

This project supports the PIER Program objectives of:

- Improving the reliability/quality of California's electricity by reducing service interruptions through a rational utilization of the existing infrastructure to implement a significant DR capability in LCI&I buildings.
- Maximizing the market connection by understanding what other states have done and proposing changes to the market that utilize these proven strategies, and yet meet California's unique requirements.
- Improving the energy cost/value of California's electricity by providing the basis for a real-time information and control system at CAISO that can automatically respond to supply-side problems, using load as a resource.

Proposed Outcomes:

1. Evaluate the technological performance of automated demand-response hardware and software systems in large commercial, semi- industrial and institutional buildings.
2. Study a functioning market in New York State that has real-time, demand-response programs that have attracted significant participation and support from large customers for four years in a restructured electricity market.
3. Conduct interviews with CAISO staff to develop a research agenda to identify how responsive loads could increase power system reliability and adequacy, what behavior are desirable, and what reliability services (ancillary services) responsive loads could provide.

Actual Outcomes:

1. The first research activity achieved the following objectives:

   Improved understanding of the status of automated demand responsive building systems, particularly the levels of automation in best practices.
   Quantified demand-savings response of automated systems.
   Identified technology gaps and priorities to improve future systems.
   Provided understanding about key features of the market for DR systems and decision making perspectives about the adoption of DR technology.
   Developed and tested a real-time signal to initiate an automated demand response.

2. The second project achieved the following technical objectives:

   Assessed customer response to tariffs based on day-ahead wholesale market prices (i.e., RTP) in a retail competition environment.
   Assessed relative merits and relationship between alternative programs/strategies (e.g., "real-time pricing" tariffs, price-responsive load bidding programs administered by ISOs) that seek to increase customer participation in electricity markets.

3. The third project made the following findings:

   • Though there has been relatively little impact with demand response programs to date, ISO personnel believe that responsive load has the *potential* to be a significant resource to increase reliability and mitigate price volatility.
   • Demand response must be location specific to have real value.
   • Demand response programs must not increase the CAISO work load.
   • Demand response programs must not degrade the CAISO's ability to forecast load. The response itself must be simple and certain.
   • For a demand response program to be accepted, the benefits for the individual and the power system must be clear to customers, system operators, and regulators.

Project Status:

The first research activity evaluated the technological performance of automated demand-response hardware and software systems in large commercial, semi- industrial and institutional buildings. The goal was to help establish a baseline DR capability by defining the amount of DR that might be available from LCI&I facilities during the next electricity crisis. The baseline includes only already in-place technologies and control strategies. The findings are documented in "Development and Evaluation of Fully Automated Demand Response in Large Facilities" by M. A. Piette, O. Sezgen, D. S. Watson, N. Motegi, and C. Shockman. CEC 500-2005-013. January 2005.

The second research activity studied a functioning market in New York State that has real-time, demand-response programs that have attracted significant participation and support from large customers for four years in a restructured electricity market. The programs were evaluated with respect to how they might be used in California to create a vibrant demand response market. The findings are documented in "Customer Response to Day-ahead Wholesale Market Electricity Prices: Case Study of RTP Program Experience in New York" by C. Goldman, N. Hopper, O. Sezgen, M. Moezzi, and R. Bharvirkar, B. Neenan, R. Boisvert, P. Cappers, D. Pratt. LBNL-54761. June 2004. For the final report, please right click on www.energy.ca.gov/pier/final_project_reports/CEC-500-2005-120.html